CLAIMS

1. A method for reconstructing surface geometry from discrete points on an object comprising steps of;

providing input data derived from said discrete points;

generating a graph from said input data, said graph including biconnected graphs;

subjecting said graph to triconnected component decomposition to generate a component graph;

generating all possible embeddings including possible face loops from said component graph;

filling said possible face loops with possible surfaces to reconstruct said surface geometry;

examining geometrical acceptance of said surfaces and omitting embeddings including at least one geometrically unacceptable surface from reconstruction and scoring said embeddings depending on said examination; and

sorting said embeddings with respect to said scores to select embeddings for reconstructing said surface geometry.

2. The method according to the claim 1, wherein said discrete points forms a wire-frame corresponding to said object.

3. The method according to the claim 1, wherein said examining and scoring step of said embeddings includes steps of;

examining geometrical acceptance of said possible surfaces and scoring said face loops;

examining geometrical acceptance of combinations of said possible surfaces and scoring said combinations; and

examining surface area of said embeddings and scoring said surface area.

4. The method according to the claim 3, wherein said step of examining said possible surfaces utilize characteristics selected from the group consisting of a kind of surface, an area, and a variation rate an range of normal vectors of the possible surface or any combinations thereof and said step of examining said combinations of said possible surfaces utilizes other

characteristics selected from the group consisting of an interference between said possible surfaces, a contact between said possible surface at edges, and an overlap between said possible surfaces or any combinations thereof.

5. The method according to the claim 1, wherein further comprising a step of discarding at least one acceptable face loop so as to reconstruct said surface geometry of an open shell structure.

6. The method according to the claim 5, wherein said at least one acceptable face loop is determined by the following formula;

$$\frac{S_{\max}}{\sum_i S_i} > 0.30 \quad and \quad \frac{S_{next}}{S_{\max}} < 0.5$$

wherein S_{max} and S_{next} are a surface area of the largest face loop and a surface area of the second largest surface area, respectively and S_i is an area of each face loop.

7 A system for reconstructing surface geometry from discrete points on an object comprising;

means for providing input data derived from said discrete points;

means for generating a graph from said input data, said graph including biconnected graphs;

means for subjecting said graph to triconnected component decomposition to generate a component graph;

means for generating all possible embeddings including possible face loops from said component graph;

means for filling said possible face loops with possible surface to reconstruct said surface geometry;

means for examining geometrical acceptance of said surfaces and omitting embeddings including at least one geometrically unacceptable surface from reconstruction and scoring said embeddings depending on said examination; and

means for sorting said embeddings with respect to said scores to select embeddings for reconstructing said surface geometry.

8. The system according to the claim 7, wherein said discrete points forms a wire-frame

corresponding to said object.

9. The method according to the claim 7, wherein said means for examining and embeddings comprising;

means for examining geometrical acceptance of said possible surfaces and scoring said face loops;

means for examining geometrical acceptance of combinations of said possible surfaces and scoring said combinations; and

means for examining surface area of said embeddings and scoring said surface area.

10. The system according to the claim 9, wherein said means for examining said possible surfaces utilize characteristics selected from the group consisting of a kind of surface, an area, and a variation rate and range of normal vectors of the possible surface or any combinations thereof and said means for examining said combinations of said possible surfaces utilizes other characteristics selected from the group consisting of an interference between said possible surfaces, a contact between said possible surface at edges, and an overlap between said possible surfaces or any combinations thereof.

11. The system according to the claim 9, wherein further comprising means for discarding at least one acceptable face loop so as to reconstruct said surface geometry of an open shell structure.

12. The system according to the claim 7, wherein said at least one acceptable face loop is determined by the following formula;

$$\frac{S_{\max}}{\sum_i S_i} > 0.30 \quad and \quad \frac{S_{next}}{S_{\max}} < 0.5$$

wherein S_{max} and S_{next} are a surface area of the largest face loop and a surface area of the second largest surface area, respectively and S_i is an area of each face loop.

13. The system according to the claim 7, wherein said system is a computer aided design system.

14 A computer readable program product for reconstructing surface geometry from

discrete points on an object comprising;

providing input data derived from said discrete points;

generating a graph from said input data, said graph including biconnected graphs;

subjecting said graph to triconnected component decomposition to generate a component graph;

generating all possible embeddings including possible face loops from said component graph;

filling said possible face loops with possible surface to reconstruct said surface geometry;

examining geometrical acceptance of said surfaces and omitting embeddings including at least one geometrically unacceptable surface from reconstruction and scoring said embeddings depending on said examination; and

sorting said embeddings with respect to said scores to select embeddings for reconstructing said surface geometry.

15. The program product according to the claim 14, wherein said discrete points forms a wire-frame corresponding to said object.

16. The program product according to the claim 14, wherein said means for examining and embeddings comprising;

examining geometrical acceptance of said possible surfaces and scoring said face loops;

examining geometrical acceptance of combinations of said possible surfaces and scoring said combinations; and

examining surface area of said embeddings and scoring said surface area.

17. The program product according to the claim 16, wherein wherein said step of examining said possible surfaces utilize characteristics selected from the group consisting of a kind of surface, an area, and a variation rate and range of normal vectors of the possible surface or any combinations thereof and said step of examining said combinations of said possible surfaces utilizes other characteristics selected from the group consisting of an interference between said possible surfaces, a contact between said possible surface at edges, and an overlap between said possible surfaces or any combinations thereof.

18. The system according to the claim 16, wherein further comprising a step of discarding at least one acceptable face loop so as to reconstruct said surface geometry of an open shell structure.

19. The system according to the claim 14, wherein said at least one acceptable face loop is determined by the following formula;

$$\frac{S_{\max}}{\sum_i S_i} > 0.30 \quad \textit{and} \quad \frac{S_{next}}{S_{\max}} < 0.5$$

wherein S_{max} and S_{next} are a surface area of the largest face loop and a surface area of the second largest surface area, respectively and S_i is an area of each face loop.

20. The program product according to the claim 14, wherein said program product is implemented in a computer aided design system.